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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte THOMAS JAMES BATZINGER,
WEI LI, MICHAEL SCOTT LAMPHERE,
THOMAS WALTER ROGENSKI, BIN WEI,
CARL STEPHEN LESTER and ROBERT JOHN FILKINS

Appeal 2008-3117
Application 10/706,472
Technology Center 1700

Decided: June 30, 2008

Before CHARLES F. WARREN, THOMAS A. WALTZ, and MICHAEL P. COLAIANNI, *Administrative Patent Judges*.

WARREN, *Administrative Patent Judge*.

DECISION ON APPEAL

Applicants appeal to the Board from the decision of the Primary Examiner finally rejecting claims 1 through 21 in the Office Action mailed December 22, 2006 (Office Action). 35 U.S.C. §§ 6 and 134(a) (2002); 37 C.F.R. § 41.31(a) (2006).

We affirm the decision of the Primary Examiner.

Claim 1 illustrates Appellants' invention of a method of monitoring machining in an electrochemical machining tool assembly, and is representative of the claims on appeal:

1. A method of monitoring machining in an electrochemical machining tool assembly having at least one electrode arranged across a gap from a workpiece, the electrode being energized by application of a potential difference ΔV between the electrode and the workpiece, said method comprising:

exciting at least one ultrasonic sensor to direct an ultrasonic wave toward a surface of the electrode;

receiving a reflected ultrasonic wave from the surface of the electrode using the ultrasonic sensor of the electrode and from a surface of the workpiece; and

synchronizing the excitation of the ultrasonic sensor to a machining cycle of the electrochemical machining tool, the synchronizing comprising delaying the excitation of the ultrasonic sensor a dwell time T_d after a reduction of the potential difference ΔV across the electrode and the workpiece occurs, such that the exciting and receiving are performed during a plurality of machining off-times.

The Examiner relies upon the evidence in these references (Ans. 2):

Li	US 6,355,156 B1	Mar. 12, 2002
Klocke	US 2003/0079989 A1	May 1, 2003

Appellants request review of the following grounds of rejection advanced on appeal (Br. 6):

claims 1, 2, 8, 10 through 12, 15, 18, and 20 under 35 U.S.C. § 102(b) over Li (Ans. 3);

claims 3, 9, 19, and 21 under 35 U.S.C. § 103(a) over Li (Ans. 5); and

claims 3 through 7, 13, 14, 16, 17, and 19 under 35 U.S.C. § 103(a) over Li in view of Klocke (Ans. 7).

Appellants argue the claims in the first ground of rejection as a group; claims 3 and 9 of the second ground of rejection with specificity; and claim 4 of the third ground of rejection with specificity. Br. 7, 9, 10-13, and 13-15. Thus, we decide this appeal based on claims 1, 3, 4, and 9, and on the remaining claims as argued in the Brief. 37 C.F.R. § 41.37(c)(1)(vii) (2006).

The principal issues in this appeal are whether the Examiner has carried the burden of establishing a prima facie case in each of the grounds of rejection advanced on appeal which, of course, turn on the issues addressed below.

The plain language of independent claim 1 specifies, with reference to Specification Figures 1-4, a method of monitoring machining of any workpiece 12 with any manner of electrochemical machining tool assembly 10 which has at least one electrode, such as 26, 28, arranged with a gap between the electrode and the workpiece 12, with a potential difference ΔV between the electrode and the workpiece, and at least one ultrasonic sensor, such as 42, 44, which can be in the electrode. Illustrated workpiece 12 is an airfoil section of a rotor blade. The method comprises at least, among other things, the steps of (1) exciting the ultrasonic sensor at least to the extent that an ultrasonic wave is directed toward any surface of the electrode; (2) the ultrasonic sensor receiving a reflected ultrasonic wave from that surface, wherein the reflected ultrasonic wave comprises at least a plurality of reflected waves from the electrode surface and any surface of the workpiece; and (3) synchronizing the excitation of the ultrasonic sensor with a machining cycle of the assembly, wherein the synchronizing step

comprises at least delaying the excitation of the sensor any dwell time T_d after any reduction in the potential difference ΔV occurs, "such that the exciting and receiving are performed during a plurality of machining off-times." *See* Spec., e.g., ¶¶ 0017-0021.

Dependent claim 3 specifies a "continuous" assembly wherein the potential difference ΔV is repeatedly reduced to generate a series of measurement periods Δt_M. We interpret this claim in the context of independent claim 1 to encompass methods that include a continuously pulsed ECM tool assembly with ultrasonic sensor excitation synchronized with a plurality of machining off-times. Dependent claim 4 specifies the dwell time T_d range of seven milliseconds to about 15 milliseconds. Dependent claim 9 specifies an assembly with two ultrasonic sensors each of which directs an ultrasonic wave toward a surface of its respective electrode, wherein the excitation of one of the sensors is delayed any dwell time T_d, the excitation of the other sensor is delayed any dwell time T_d plus an offset δ, and "the offset δ is at least the time required to attenuate the ultrasonic wave from the first one of the ultrasonic sensors."

We find Li would have evinced that one of ordinary skill in this art would have been familiar with the structure and operation of an electrochemical machining (ECM) assembly including a gap between the cutting surface of an electrode and a workpiece, wherein the gap is filled with "a pressurized, flowing, aqueous electrolyte" that acts as an electrical current carrier and removes and carries away metal ions from the workpiece. Li col. 1, ll. 11-26. Li further evinces that these persons would have known that the gap size should be maintained within a proper range to provide

dimensional accuracy of the workpiece, such that "[m]onitoring and controlling the gap size between the tool and the workpiece, or directly monitoring the workpiece thickness, is important for ECM tolerance control," and would have used "suitable means for sensing gap size or workpiece thickness" to provide ECM accuracy control. Li col. 1, ll. 27-53. Li further evinces that these persons would have known that one factor in affecting a change in gap size is a change in conductivity of the electrolyte because of "gas bubble generation on the tool surface." Li col. 1, ll. 46-49.

We find Li would have described to one of skill and one of ordinary skill in this art the use of an ultrasonic sensor in an ECM assembly to measure both the gap size and the workpiece thickness, which assembly "is particularly applicable to the ECM of turbine compressor airfoils." Li col. 2, ll. 10-16. Li's method to operate the assembly comprises, among other steps, flowing an electrolytic fluid in the gap between the tool and the workpiece, using the ultrasonic sensor to generating an acoustic wave through the fluid to the workpiece and receive a reflected wave, and using the reflected wave to calculate the thickness of the size of the gap between the tool and the workpiece and/or the thickness of the workpiece. Li col. 2, ll. 17-36, and col. 2, l. 62, to col. 3, l. 13. The reflected wave includes a wave reflected from the cutting surface of the tool and a wave reflected from a working surface of the workpiece, which waves have different arrival times at the sensor and are used in this respect in the calculation step. Li col. 2, ll. 37-48.

Li illustrates the method, with reference to Li Figures 1 and 2, with ECM tool assembly 10 with the cutting surfaces 22a, 22b of electrodes 12a,

12b on either side of and capable of moving toward and away from airfoil workpiece 16, wherein ultrasonic sensor 14 is embedded in electrode 12a. Li col. 3, ll. 24-61, and col. 4, ll. 14-15. Electrolyte 18 is pumped through the gap between the surfaces of electrodes 12a, 12b and workpiece 16 to provide for current flow and remove material machined from workpiece 16. Li col. 3, l. 62 to col. 4, l. 13.

Li discloses ultrasonic sensor 14 is connected to pulser-receiver device 32 which is connected to data acquisition system 34 that controls the operation of ultrasonic sensor 14 and calculates the thickness of gap 26 between electrode 12a and workpiece 16 as well as the thickness of workpiece 16. Li col. 4, ll. 15-22. The acoustic wave generated by ultrasonic sensor 14 is reflected back to the sensor from the cutting surface 22a of electrode 12a with a first arrival time and from surface 24a of workpiece 16 with a second arrival time, which arrival times are used by data acquisition system 34 for calculation. Li col. 4, l. 22 to col. 5, l. 5.

Li discloses

> The acoustic wave velocity in electrolytic fluid 18 can vary due to changes in density of the electrolytic fluid. . . . During the electrochemical machining process, gas bubbles are usually generated at cutting surfaces 22 of electrochemical machining tool 12. The gas bubbles may cause ultrasonic acoustic wave attenuation. D.C. power supply 20 may be turned off for a brief period of time, such as for the time interval used in pulsed electrochemical machining, or the voltage of D.C. power supply 20 may be reduced so as to minimize the generation of gas bubbles in order for a more accurate measurement to be made.

Li col. 5, ll. 31-45.

The contents of Klocke are unnecessary to our decision. *See In re Jones*, 958 F.2d 347, 349 (Fed. Cir. 1992); *In re Kronig*, 539 F.2d 1300, 1302-04 (CCPA 1976).

The Examiner finds "it is well understood that pulsed ECM has multiple off-time cycles." Office Action 3; Ans. 9. Appellants do not dispute the Examiner's finding. Br. in entirety. *See, e.g., In re Ahlert*, 424 F.2d 1088, 1091 (CCPA 1970) ("Where the appellant has failed to challenge a fact judicially noticed and it is clear that he has been amply apprised of such finding so as to have the opportunity to make such challenge, the board's finding will be considered conclusive by this court.").

We consider first the ground of rejection of § 102(b). There is no dispute that Li employs an ECM tool assembly that satisfies the apparatus requirements of claim 1 including the ultrasonic sensor. We determine the Examiner establishes that, prima facie, as a matter of fact, Li's disclosure at col. 5, ll. 37-45, in the context of the disclosure of the reference as a whole including the evidence of knowledge in the prior art, provides a description of the claimed method encompassed by claim 1, as we interpret this claim above, to one skilled in this art within the meaning of this statutory provision. Ans. 3-5 and 8-9.

The Examiner finds that one skilled in this art would recognize in Li's disclosed method "an inherent delay (i.e., a dwell time) between the decrease in DC voltage and measurement made by ultrasonic sensor due to the inherent time it takes to transmit electronic signals." Ans. 3-4. The Examiner further finds that "synchronizing is inherent in operation of the ultrasonic sensor with the ECM tool in that excitation of the ultrasonic tool

is suggested during the off time interval of pulsed electrochemical machining" because "[m]ultiple measurements of the ultrasonic sensor would be inherently made in that the ultrasonic sensor is used in a method of ECM monitoring, and thus requiring multiple thickness measurement;" and in view of the "operation of the ultrasonic sensor during machining off-times (off cycle of pulsed ECM . . .)." Ans. 4-5. The Examiner still further finds that inherently "making multiple measurements of the ultrasonic sensor in that the ultrasonic sensor is used in a method of ECM monitoring, and thus requiring multiple thickness measurements." Ans. 5.

We are of the opinion that the Examiner, in stating the findings, uses the term "inherent" and "inherently" in the sense of whether the reference would describe a process to one skilled in the art given this person's knowledge of the art, and not whether a disclosed process includes a particular step or result. *Compare, e.g., In re Graves*, 69 F.3d 1147, 1152 (Fed. Cir. 1995), and cases cited therein ("[A] skilled artisan could take [the reference's] teachings in combination with his own knowledge and be in possession of the [claimed system] device."), *and In re Preda*, 401 F.2d 825, 826 (CCPA 1968) ("[I]n considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom." (citation omitted)), *with, e.g., In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981) ("[t]he mere fact that a certain thing may result from a given set of circumstances is not sufficient. (citations omitted)." *In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981), *and In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999) ("[T]he Board's analysis rests

upon the very kind of probability or possibility – the odd use of fasteners with other than their mates – that this court has pointed out is insufficient to establish inherency."), *and Continental Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 1268 (Fed. Cir. 1991) (silence in a reference about an inherent characteristic may be explained by extrinsic evidence which "must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill").

Thus, one skilled in this art armed with the knowledge in the art would have found in Li a description of a problem with ultrasonic wave attenuation caused by gas bubbles in the electrolytic fluid in the gap between the electrodes and the workpiece, and would have reasonably recognized from Li's description of the method of solving the problem by reducing the gas bubbles in the fluid to increase measurement accuracy, that bubble minimization would require at least a short period following the reduction or turn-off of electric power. In this respect, we further find that in addition to the method step of turning-off or reducing the electric power supplied to the electrodes as a means to minimize the gas bubbles as described by Li, this person as well as one of ordinary skill in this art would have further readily observed that once the electric power was reduced or turned-off, the pressurized flow of electrolytic fluid through the gap between the workpiece and the electrodes would remove gas bubbles at least to some extent, thus further minimizing this problem. *See, e.g.*, *In re Ludwig*, 353 F.2d 241, 243 (CCPA 1965); *In re Goodman*, 339 F.2d 228, 232-33 (CCPA 1964).

On this basis, we find one skilled in this art armed with the knowledge in the art following Li would have configured Li's data acquisition system and pulser-receiver to excite the ultrasonic sensor at a time of bubble minimization, that is, a time after the power to the electrodes has been reduced or turned-off, thus synchronizing excitation of the sensor with adjustment of the power supply. This person would have further recognized that Li describes the solution with respect to pulsed ECM with its multiple off-time cycles, and would have taken measurements during plural off-cycles as monitoring gap size and workpiece thickness is recognized in the art as important for dimensional accuracy in the workpiece.

Accordingly, on this record, Li, prima facie, as a matter of fact describes to and places in possession of one skilled in the ECM arts, each and every limitation of the claimed method encompassed by claim 1, arranged as required therein. *See, e.g., In re Schreiber*, 128 F.3d 1473, 1477 (Fed. Cir. 1997), and cases cited therein; *In re Spada*, 911 F.2d 705, 707 (Fed. Cir. 1990).

Upon reconsideration of the record as a whole in light of Appellants' contentions, we are of the opinion that Appellants have not successfully rebutted the prima facie case of anticipation. We find that, contrary to Appellants' contentions, Li in fact discloses a data acquisition system coupled with a pulser-receiver means to control the excitation of the ultrasonic sensor, receipt of plural reflected ultrasonic acoustic waves, and calculation of gap width and workpiece thickness from the reflected waves. Br. 8. Thus, one skilled in this art following Li can synchronize Li's ECM tooling assembly to take measurements during off-time cycles of pulsed

electrochemical machining when gas bubbles are minimized according to Li's described method for solving the wave attenuation problem caused by gas bubbles. Accordingly, we are not persuaded otherwise by Appellants' contentions. Br. 8-9. Indeed, Appellants have not established that one skilled in this art would expect an immediate minimization of gas bubbles on the cutting surfaces of the electrodes at the precise time the power is turned off.

Accordingly, based on our consideration of the totality of the record before us, we have weighed the evidence of anticipation found in Li with Appellants' countervailing evidence of and argument for non-anticipation and conclude that the claimed invention encompassed by appealed claims 1, 2, 8, 10 through 12, 15, 18, and 20 would have been anticipated as a matter of fact under 35 U.S.C. § 102(b).

Turning now to the ground of rejection of claims 3 and 9 under § 103(a), we determine that Li, the scope of which we determined above, provides evidence supporting the Examiner's case that the claimed invention encompassed by claims 3 and 9, as we interpreted these claims above, would have been prima facie obvious to one of ordinary skill in the ECM arts familiar with machining airfoil sections of turbine blades. With respect to claim 3, the Examiner determines this person in following Li would have synchronized the excitation of the ultrasonic sensor with the off-time cycles of pulsed electrochemical machining which minimizes gas bubbles. Ans. 5-6. With respect to claim 9, the Examiner determines that this person would have modified Li's ECM tool assembly to include an ultrasonic sensor in electrode 12b "in order to monitor the second side of the airfoil" workpiece,

and would have recognized that "an offset time between ultrasonic sensor signal excitation is a necessary adjustment inherent to a control system employing multiple emitting/receiving sensors in order to avoid attenuation or interference." Ans. 6 and 9-10.

We interpreted claim 3 to included pulsed ECM machining. Based on the same factual foundation we found above (*see above* pp. 7-9), we determine here that one of ordinary skill in this art armed with the knowledge in the art following Li[1] would have configured Li's data acquisition system and pulser-receiver to excite the ultrasonic sensor at a time of bubble minimization, that is, a time after the power to the electrodes has been reduced or turned-off, thus synchronizing excitation of the sensor with adjustment of the power supply. As the Examiner points out, this person would have recognized that Li describes the solution with respect to pulsed ECM with its multiple off-time cycles, and would have taken measurements during plural off-cycles to monitor gap size and workpiece thickness because the art recognizes that frequent measurements are important for dimensional accuracy in the workpiece. On this basis, we are of the opinion that Li would have described the claimed method encompassed by claim 3, thus anticipating this claim. It is well settled that

[1] It is well settled that a reference stands for all of the specific teachings thereof as well as the inferences one of ordinary skill in this art would have reasonably been expected to draw therefrom, *see In re Fritch*, 972 F.2d 1260, 1264-65 (Fed. Cir. 1992); *Preda*, 401 F.2d at 826 (CCPA 1968), presuming skill on the part of this person. *In re Sovish*, 769 F.2d 738, 743 (Fed. Cir. 1985).

"anticipation is the ultimate of obviousness." *See In re Baxter Travenol Labs.*, 952 F.2d 388, 392 (Fed Cir. 1991), citing *In re Fracalossi*, 681 F.2d 792, 794 (CCPA 1982).

With respect to claim 9, we agree with the Examiner that one of ordinary skill in this art would have reasonably added an ultrasonic sensor to the other electrode of Li's ECM tool assembly in the reasonable expectation of taking measurements with ultrasonic acoustic waves to monitor gap size and workpiece thickness from the perspective of both sensors because of art reorganization of the importance of measurements for dimensional accuracy in the workpiece. We further agree with the Examiner that this person would have readily recognized the necessity to keep separate the ultrasonic acoustic waves and the respective reflected ultrasonic acoustic waves for measurement accuracy. *See, e.g., KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1739 (2007)(a patent claiming a combination of elements known in the prior art is obvious if the improvement is no more than the predictable use of the prior art elements according to their established functions); *B.F. Goodrich Co. v. Aircraft Braking Sys. Corp.*, 72 F.3d 1577, 1582 (Fed. Cir. 1996) ("When obviousness is based on a particular prior art reference, there must be a showing of a suggestion or motivation to modify the teachings of that reference. This suggestion or motivation need not be expressly stated." (citation omitted)); *In re Harza*, 274 F.2d 669, 671 (CCPA 1960) ("It is well settled that the mere duplication of parts has no patentable significance unless a new and unexpected result is produced, and we are of the opinion that such is not the case here.").

Accordingly, we determine that prima facie one of ordinary skill in this art routinely following the teachings of Li would have reasonably arrived at the claimed method encompassed by claims 3 and 9 without resort to Appellants' Specification. *See, e.g., KSR*, 127 S. Ct. at 1740-41 ("[A]nalysis [of whether the subject matter of a claim would have been obvious] need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ."); *In re Kahn*, 441 F.3d 977, 985-88 (Fed. Cir. 2006); *In re O'Farrell*, 853 F.2d 894, 903-04 (Fed. Cir. 1988) ("For obviousness under § 103, all that is required is a reasonable expectation of success." (citations omitted)); *Sovish*, 769 F.2d at 743 (skill is presumed on the part of one of ordinary skill in the art); *In re Bozek*, 416 F.2d 1385, 1390 (CCPA 1969) ("Having established that this knowledge was in the art, the examiner could then properly rely, as put forth by the solicitor, on a conclusion of obviousness 'from common knowledge and common sense of the person of ordinary skill in the art without any specific hint or suggestion in a particular reference.'").

Upon reconsideration of the record as a whole in light of Appellants' contentions, we are of the opinion that Appellants have not successfully rebutted the prima facie case of obviousness of claims 3 and 9. With respect to claim 3, we are no more persuaded here than we were above by Appellants' contentions that Li does not disclose means to control excitation of the ultrasonic sensor. *See above* pp. 10-11; Br. 11. With respect to claim 9, we disagree with Appellants' contentions that there would have been no reasonable expectation of success in using an ultrasonic sensor in the other

electrode of Li's EMC tool assembly and thus, the situation is one of "obvious to try." Br. 12. Indeed, the measurement of the gap between workpiece 16 and electrode 12b of Li' assembly would be a predictable result within the ordinary skill in this art. Thus, this person would have had a reasonable expectation of success of obtaining more precise measurements of the gap between the workpiece and each of the electrodes and of the thickness of the workpiece in making this modification even though the modification was not expressly suggested by Li. *See also KSR,* 127 S.Ct. at 1742 ("When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp."). With respect to claims 19 and 21, Appellants rely on "analogous" contentions made with respect to claim 1 and do not raise further specific contentions with respect to either of these claims. Br. 12-13. Arguments which Appellants could have made but chose not to make in the Brief have not been considered and are deemed waived. *See* 37 C.F.R. § 41.37(c)(1)(vii) (2006); *cf. In re Baxter Travenol Labs.*, 952 F.2d 388, 392 (Fed. Cir. 1991) ("It is not the function of this court to examine the claims in greater detail than argued by appellant, looking for nonobvious distinctions over the prior art.").

With respect to the ground of rejection of claim 4 under § 103(a), we determine that Li, the scope of which we determined above, provides evidence supporting the Examiner's case that the claimed invention encompassed by claim 4 as we interpreted this claim above, would have been prima facie obvious to one of ordinary skill in this art. The Examiner

determines in following the teachings of Li, "one of ordinary skill would realize that dwell time is directly related to bubble minimization, in that, the longer the electrode is not energized, the more time there is for impinging flow to clear the electrode surface of bubbles to allow an accurate measurement." Thus, the Examiner concludes that this person would have recognized from Li that minimizing gas bubble is a result effective variable and would have optimized gas bubble minimization. Ans. 7-8. We agree with the Examiner's determination in view of Li's description of the method for solving the gas bubble problem with respect to off-time cycles of pulsed electrochemical machining which we discussed above. *See, e.g., In re Aller*, 220 F.2d 454, 456-58 (CCPA 1955) (it is not inventive to discover by routine experimentation optimum or workable ranges for general conditions disclosed in the prior art).

Accordingly, we are of the opinion that prima facie one of ordinary skill in this art routinely following the teachings of Li would have reasonably arrived at the claimed method encompassed by claim 4 without resort to Appellants' Specification.

Upon reconsideration of the record as a whole in light of Appellants' contentions, we are of the opinion that Appellants have not successfully rebutted the prima facie case of obviousness of claim 4. We determine that Li alone places one of ordinary skill in this art in possession of the method encompassed by claim 4, and accordingly, we do not need to consider Klocke in this respect. *See* Br. 13. With respect to the remaining claims subject to this ground of rejection, Appellants rely on "analogous" contentions made with respect to claim 1 and do not raise further specific

contentions with respect to either of these claims. Br. 13 and 14-15. As was the case above, arguments which Appellants could have made but chose not to make in the Brief have not been considered and are deemed waived. *See* 37 C.F.R. § 41.37(c)(1)(vii) (2006); *cf. Baxter Travenol*, 952 F.2d at 392.

Accordingly, based on our consideration of the totality of the record before us, we have weighed the evidence of obviousness found in Li alone and as combined with Klocke with Appellants' countervailing evidence of and argument for nonobviousness and conclude that the claimed invention encompassed by appealed claims 3 through 7, 9, 13, 14, 16, 17, 19, and 21 would have been obvious as a matter of law under 35 U.S.C. § 103(a).

The Primary Examiner's decision is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

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